

## TEACHER BELIEFS ABOUT EQUITY IN A MATHEMATICS AND SCIENCE REFORM PROGRAM

### Introduction

In this paper, we address one of the major questions discussed in Research for Action's evaluation of the second year of the Philadelphia Urban Systemic Program. The Urban Systemic Program is funded by the National Science Foundation with the goal of achieving equity in mathematics and science education for all students, and as part of the evaluation research we asked "*What are the beliefs of Urban Systemic Program teacher leaders about equity issues in mathematics and science education?*"

The Urban Systemic Program (USP) provides the School District of Philadelphia with professional development and guidance in implementing effective science, mathematics and technology programs. USP strives to build a cadre of teacher leaders with the skill and commitment to increase racial and cultural equity in student outcomes through providing workshops in leadership training, inquiry workshops in mathematics and science, hands-on instructional approaches in mathematics and science, content courses, and other graduate classes. During the year this evaluation covered (2001-2002), the program provided professional development to approximately 200 participants identified as "teacher leaders" and approximately 850 other teachers.

This paper highlights the voices of teacher leaders in the Urban Systemic Program as a way to keep visible the hard work and commitment of classroom teachers during a year of state-takeover and privatization. By and large, the sample of Philadelphia teachers that we interviewed were committed to working in Philadelphia because they believed that urban students needed the best possible mathematics and science teachers, but they felt undervalued and under attack in the media, in the political arena, and sometimes even in their own schools. These teachers generously invited us into their classrooms and shared their perceptions of their strategies, their successes, and their challenges in teaching mathematics and science to students from racial and economic groups that have traditionally been excluded from these fields.

To collect and analyze data, Research for Action developed case-studies of a sample of thirteen USP participants. These case-studies were integrated with a USP survey, a database managed by USP, and test data about student outcomes. Case-study teachers were chosen to represent a range of grade levels, geographic areas, and roles within USP. The case-study sample was designed to focus on teachers who had attended at least ten hours of USP professional development during the previous school year and summer<sup>1</sup>.

### Mathematics and Science for All

"Mathematics for all" and "science for all" are key goals of the current reform movements in mathematics and science education. The importance of high quality mathematics and science education for minority communities is starkly articulated by Robert Moses. Moses is the national director of the Algebra Project, which "is founded

on the idea that the ongoing struggle for citizenship and equality for minority people is now linked to an issue of math and science literacy." (Moses and Cobb 2001. 14). According to Moses, "Math illiteracy is not unique to Blacks the way the denial of the right to vote in Mississippi was. But it affects Blacks and other minorities much, much more intensely, making them the designated serfs of the of the information age just as the people that we worked with in the 1960s on the plantations were serfs then" (11).

RFA believes that in order to increase equity in mathematics and science education, it is essential to understand more about how teachers currently engage with equity issues. We begin this paper by presenting the portraits of three teachers who are committed to increasing equity in mathematics and science teaching and learning. Following the portraits, we analyze the motivation, philosophies, and attitudes about equity among the larger set of thirteen case-study teachers<sup>2</sup>. These data suggest that public school teachers who are committed to equity:

- feel a personal connection to the students they are teaching,
- believe that rigorous mathematics and science standards are achievable by all students, and
- are skeptical about the possibility of improving equity without increases in resources to urban communities and urban schools.

## **Portraits of Three Teacher Leaders**

### **Sandra Bowens**

Sandra Bowens, an African American woman in her early 50's, has been teaching for 28 years. Prior to teaching in Philadelphia, Sandra taught for a period of time in the mid-west. She has been teaching in Philadelphia for eight years and feels particularly connected to her school community because of family ties. *"I grew up in the area and my family (uncle, mother, cousins) went to this school. I went to Talcott Middle School. I come into this building and it encourages me. My family's history in this school makes me want to be the best I can be and be involved in any way I can for the children I teach."* Sandra's sense of "community-mindedness" is another incentive that motivates her to remain in teaching in Philadelphia. *"When I became a teacher, my purpose was to work with children in and around the community I lived in and I can't get away from that."*

Sandra's aspirations to pursue a career in education evolved at an early age. *"Since elementary school, I have always wanted to be a teacher; that's the only thing I ever wanted to be."* Currently an 8<sup>th</sup> grade pre-algebra and algebra teacher, Sandra has always aspired to be a math teacher. Although not certified, she measures her success in teaching math when she is able to stimulate students' interest in math. *"I have always been able to think critically and have always enjoyed helping children exercise their brain to think mathematically when they are doing anything. I have a talent to make children excited about it[math]. I've been given a gift and I really enjoy it."*

Teaching in a middle school that serves predominantly low-income African-American students, Sandra expressed a commitment to exposing this student population to the value of math. *“It [math] gave me the inspiration to want to expose other people to it. I know that women in particular, are not math –driven and I wanted young women to have that exposure and I know that African Americans – male or female – are not math-driven and I wanted to give that exposure to those children.”*

Sandra infuses a range of varied approaches in teaching math from peer tutoring to collaborative learning groups. *“I try to take different approaches where children can do some hands-on things or have peer tutoring. Sometimes what I can’t get across to a student, another student can. We do a lot of group work in the classroom so that they depend and use each other as a reference and not just me, because I can’t be with 33 children alone.”*

Serving in multiple roles as a math teacher and math leader, Sandra’s leadership is supported by her principal who has allotted time for teacher collaboration, professional development, and in-service training. She described the changes she has experienced in her leadership role because of her involvement with USP. *“USP has empowered me. The whole idea of being in a large inner city district, I felt defeated and could only touch a few children. As an educator I want to touch as many students as I could. Being a leader has empowered me. My work with other teachers allows me to touch more children.”*

### **Charles Mason**

Like Sandra, Charles grew up in Philadelphia and attended neighborhood schools. He, too, said that he *“loved math since he was young.”* He described math as a subject he could relate to his real life experiences. *“Because math is a strong subject for me; it’s a subject that I love to teach.”* Charles, a young African American male in his 20’s, was formerly an accounting major who became bored during his first semester in college. After rethinking his long-term goals, he decided that he could use math to teach and work with children. He cited his 8<sup>th</sup> grade teacher as an important influence in his life. *“My eighth grade teacher made a big difference in my life.”*

Initially, he aspired to become a high school math teacher, but because of his young age, he decided to pursue teaching at the middle school level. He is a novice teacher, recently completing his second year of teaching at Barrow. For Charles, *“the best thing about teaching is the children.”* He likes to see the *“children’s enthusiasm for learning.”* Charles teaches 5<sup>th</sup> grade at a school that has a multiracial student population of Hispanics, African Americans, and Asian Americans. He sees math as “universal” and a vehicle that helps connect students to the real world. *“In math, equity is not a problem. Math is not about race and class. Girls are also strong in math. I don’t see a problem; not even with science.”*

In his classroom, Charles has posters on his walls depicting African American scientists to remind students about the important contributions that African Americans

have made. He describes his teaching approach as "hands-on." *"I get the children as active as possible. I give them manipulatives."* He uses cooperative groups, but tries to *"to balance the group work with individual work."* Charles wants *"every child to succeed.... Even if they are not doing what I want them to, it is important to see growth and improvement."* He wants children to develop a *"love for math"* and to see *"a connection between the text and everyday life."*

Charles was selected by his principal to be a teacher leader; however, in comparison to Sandra, he has had little support for leadership in his school. *"From my understanding, I thought we would be able to take information back to the other teachers, that we would have a chance to sit down and demonstrate - show other teachers how we would do things."* According to Charles, many of his colleagues do not feel competent teaching math and he has not been allotted the time to meet with them to collaborate on teaching strategies.

### **Janice Truman**

In contrast to Sandra and Charles who were always drawn to their USP content area [mathematics], the third teacher profiled in this report, Janice Truman, became a science teacher by accident. She is a 4<sup>th</sup> grade science teacher at the Hargrove Elementary School. *"When I got to the school, they said, 'Oh hello, new science teacher.'"* After being given this role and responsibility, Janice realized she needed additional training and explored resources and professional development to support her teaching science. *"I knew I needed some type of training because I always thought of a science teacher as knowing every single thing."* To assist her in making the transition to the role of science teacher, Janice received support from several sources, including the principal and a USP teacher leader trained to coach new science teachers. Like Sandra's principal, the principal at Hargrove showed support through allotting extra time for training. *"He made time for me to do things. He got me time if I needed additional time to get something organized. He helped with the schedule so it wasn't overwhelming."*

Janice is an African American woman in her 40's who has over 16 years of teaching experience. She describes herself as having a *"natural thirst for learning"* and believes *"teaching and learning are inseparable."* A resident of Philadelphia, Janice is motivated to teach in the district because she likes the *"interaction"* she gets from urban students. Her experiences teaching a diverse student population have influenced her to appreciate the *"multiculturalism and the mix of how things come together."* As an African American teacher, Janice believes her role is *"to do all she can to bring up our children of color."* She approaches teaching students science using inquiry. *"It's good to do investigations around things that children are familiar with. This leads to further investigation and takes us places we've never been. I think it's important for us to have background knowledge in what we're teaching. I try to do some background investigation myself and call people to give me support."*

### **The Case Study Teachers: Findings**

***Finding One: The teachers express a strong commitment to their students, who are predominantly African American and Latino. Most of the African American and Latino participants in the study also describe close connections to the communities in which they work and use a discourse related to social justice, equity, and fairness to explain their motivations for teaching in Philadelphia.***

When asked to reflect on their motivations for teaching, many described themselves as “good with people,” or having an interest in “helping people.” Several reported that teaching was a childhood aspiration. “I’ve never wanted to do anything else.” “I’ve always wanted to be a teacher as a little kid.”

Over half the teachers in the sample cited that being a Philadelphia native or current resident was a major influence in their motivation to teach in the school district. Several teachers grew up in the neighborhood where they are currently teaching. Others reside in the city, articulating a preference to teach where they live. According to one, “A lot of my growth and development came from Philadelphia.”

Many of the African American teachers and the one Latina in the study talked explicitly about their passion for making a difference in communities of color. A veteran math teacher made a commitment to because of “the need to work in the inner city.” Another expressed a particular interest in teaching at a bilingual school. “I like being in a school where I can meet so many Puerto Ricans and Latino students. I like to stay around and interact with the students, the parents, and the community.” Both Janice and another elementary school teacher said they cherished their daily interactions with urban students. They feel more appreciated, as one said because “the need is stronger in Philadelphia than in other school districts, especially for minority students.”

***Finding Two: Most teachers in the sample believe that the hands-on strategies and problem-solving approaches<sup>1</sup> promoted by USP are a valuable means of supporting equity and engaging students who might otherwise be excluded from high levels of achievement in mathematics and science.***

RFA's first question about equity was purposefully open-ended, with the goal of identifying equity issues in the classroom that teachers considered important. Our opening question on this topic was: “Can you tell me a little bit about how you see equity issues around mathematics/science in your classroom?” In most cases, participants were hesitant when answering this question and probed the researchers about what we meant by equity. On the interview protocol we listed several follow-up questions as guidelines to help clarify the question about equity: “Do you do anything with multiculturalism? Do some students need special supports?” Researchers often needed to elaborate even more. For example, one member of the research team included this comment in her fieldnotes: “I told [the teacher] to think about equity in terms of gender, race, class, and special needs students and asked her ‘Do you have to adjust the curriculum so that all children are learning the same science material?’”

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The second perspective we probed was specifically about USP and included the following series of questions "Do you think USP has a vision of equity? If so, what is it? In what ways have you seen/heard USP raise the importance of equity issues in improving student outcomes?" The majority of teachers responded to these questions in the ways we describe below, but it is important to note that several teachers needed additional probes in order to articulate their perceptions of USP's vision of equity.

From their answers to the questions, it appears that USP teacher leaders regard equity in math and science education in terms of two overarching themes: (1) envisioning the goal of USP as providing high level learning in mathematics and science for ALL students, including those traditionally excluded from the fields of math and science; and (2) providing access for all students, including special needs and bilingual students, through the use of varied instructional strategies to support their learning.

Most teachers agreed that USP's vision of equity is apparent in the program's actual approach in math and science instruction. For one leader there is an "underlying theme of equity." Teachers describe alternative models, such as hands-on and inquiry-oriented approaches that they learned through USP, as mutually beneficial for themselves and for their students. For Sandra, reform mathematics programs like those espoused by USP, provide accessibility for all students. "The reform math programs help the other child who needs to see the problem in an alternative way. It's making math accessible for the children whom we thought were not bright enough for it. Now the idea is that algebra should be given to everyone so that every child can attain it."

When asked about their goals for student learning, most teachers described expectations that included both mastery of skills and the ability to engage in problem solving. This was particularly true for the teachers of elementary and middle school mathematics, who seemed quite aware of the sequence of skills and concepts that students needed to cover in order to achieve at higher levels of mathematics

Several teachers specifically identified how the approaches advocated by USP were helpful in meeting the needs of special education or bilingual students. In addition, several raised issues related to gender. Strategies for meeting the needs of special education and bilingual students included providing one-on-one assistance, allocating extra time, giving oral exams, and encouraging peer supports.

In contrast to the strong theme among many participants that USP's approach was designed to work with ALL students, a smaller number of participants felt that some special attention needed to be given to the contributions of different cultures.

***Finding Three: The teachers describe challenges in meeting the goal of high achievement for all students because of the need to grapple with the multiple academic, emotional, and social issues facing their students; the overall lack of resources in their schools; and a lack of support within their schools.***

While most of the teachers we interviewed talked about the importance of high achievement for all students, many also described a lack of adequate resources, especially for special education students. Others mentioned the number of students needing extensive emotional support or the many out-of-school problems their students face and the subsequent difficulties the students have when they try to focus on academic work. There was an overall consensus among the teachers that Philadelphia students also experience inequity due to insufficient resources to support all the strategies advocated by USP.

### **Conclusions: Balancing Pessimism and Hope**

The teachers in this sample are a committed group who have chosen to work in the Philadelphia public schools. While a few are in Philadelphia for their own convenience, or perhaps because of inertia, most stay in the system because they actively choose to work with students who need good teachers the most. This case-study sample was selected with minimal previous knowledge about the teachers, except that they had chosen to participate in USP professional development. We learned that the teachers in the sample perceive USP's approach as valuable in providing strategies and standards that are appropriate for all students. The teachers in this study also believe that equity cannot be achieved without additional resources for schools, for classrooms, and for students.

One African American male expressed the mix of hope and down-to-earth realism that characterized these teachers as a whole, when he told us:

*USP has a vision of equity. It's broad because what USP sees is a graph that shows the achievement gap. [The program director] wants that gap closed. She knows the reason is economic, socio-economic. The reason is more than the colors, than saying Hispanic or saying Black. There is an underlying theme of equity. "How to make an impact?", that is the question. I'm also sure that no one has the answer, but USP will try to address it in some way.*

Because equity issues are central to educational achievement in Philadelphia, we are continuing to examine equity as part of our ongoing research about USP. In addition to evaluating the impact of district-wide organizational and policy changes, in 2003, RFA will explore African-American male students' perceptions about mathematics and science. In addition, we are working closely with mathematics and science teachers to help them observe and analyze how their teaching impacts African-American male students in their own classrooms.

## References

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<sup>1</sup> The sample includes 9 African-Americans, 3 Euro-Americans, and 1 Latina; 9 women and 4 men; 2 elementary teachers, 7 middle grades teachers, and 4 high school teachers; and 7 math leaders and 6 science leaders.

<sup>2</sup> All names used in this paper are pseudonyms.